

# Chapter 16 Developing Interpretation Criteria

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Chapter 15 introduced you to running interpretation reports and selecting existing interpretive criteria to run against your data. This chapter demonstrates how to create new criteria. It introduces you to the NASIS Interpretation Generator and two editors used for building interpretations—the Evaluation editor and the Rule editor. With these tools, you can create and generate new interpretations based on current data and on calculations automatically performed by NASIS, which gives you the capability of applying new interpretive criteria to your soil data.

It is essential that you read Chapter 14 before attempting the lesson in Chapter 16. Prior to developing interpretive criteria, you must understand the concepts of articulating interpretive statements, fuzzy logic, and defuzzification into rating classes. See Chapter 14 for a discussion of those concepts.

The NASIS interpretation module is designed for interdisciplinary experts who thoroughly understand the process of developing interpretive criteria. In addition, they must understand the relationships of soil properties to the system or application being evaluated. Expert opinion is required throughout the process of creating interpretive criteria with NASIS.

Use of this module also requires that you have undergone basic NASIS training on the subjects of navigation, database structure, and object ownership.

## Overview of Interpretation Criteria

In NASIS, interpretive results are generated by applying interpretive criteria to soil data. Interpretive criteria are divided into four parts: *interpretations*, *base rules*, *evaluations*, and *properties*.

The first nine pages of this chapter provide a conceptual overview of interpretations. The overview requires no interaction with the tutorial database.

## NASIS interpretations

An *interpretation* or *primary rule* is a root rule in NASIS. It uses *evaluations* and *base rules* or *sub-rules* to derive values. It is a logical statement about land use, limiting features, and the relationship among limiting features. Interpretations are stored in the Rule table as shown in Figure 16-1 on the next page. The land use is identified as the Rule Name, and the interpretation's limiting features and the relationship among them (relative weights and interactions) are depicted graphically in Figure 16-2 with a special Rule Editor.

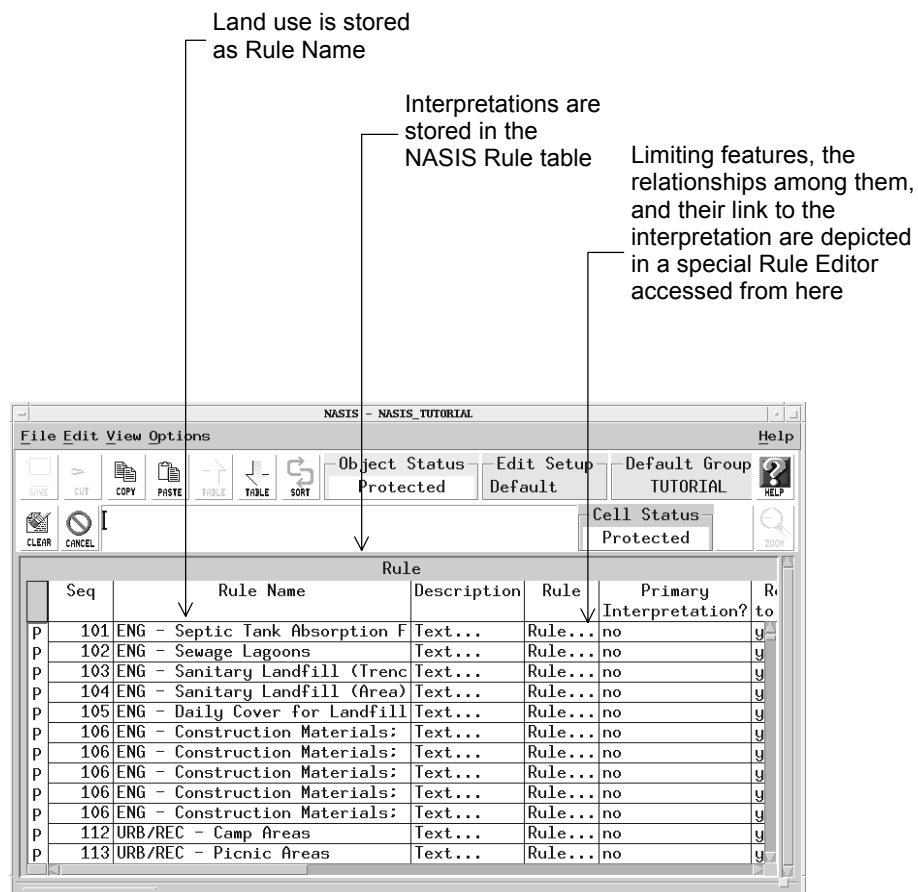


Figure 16-1. Rule Table Displaying Engineering Interpretations

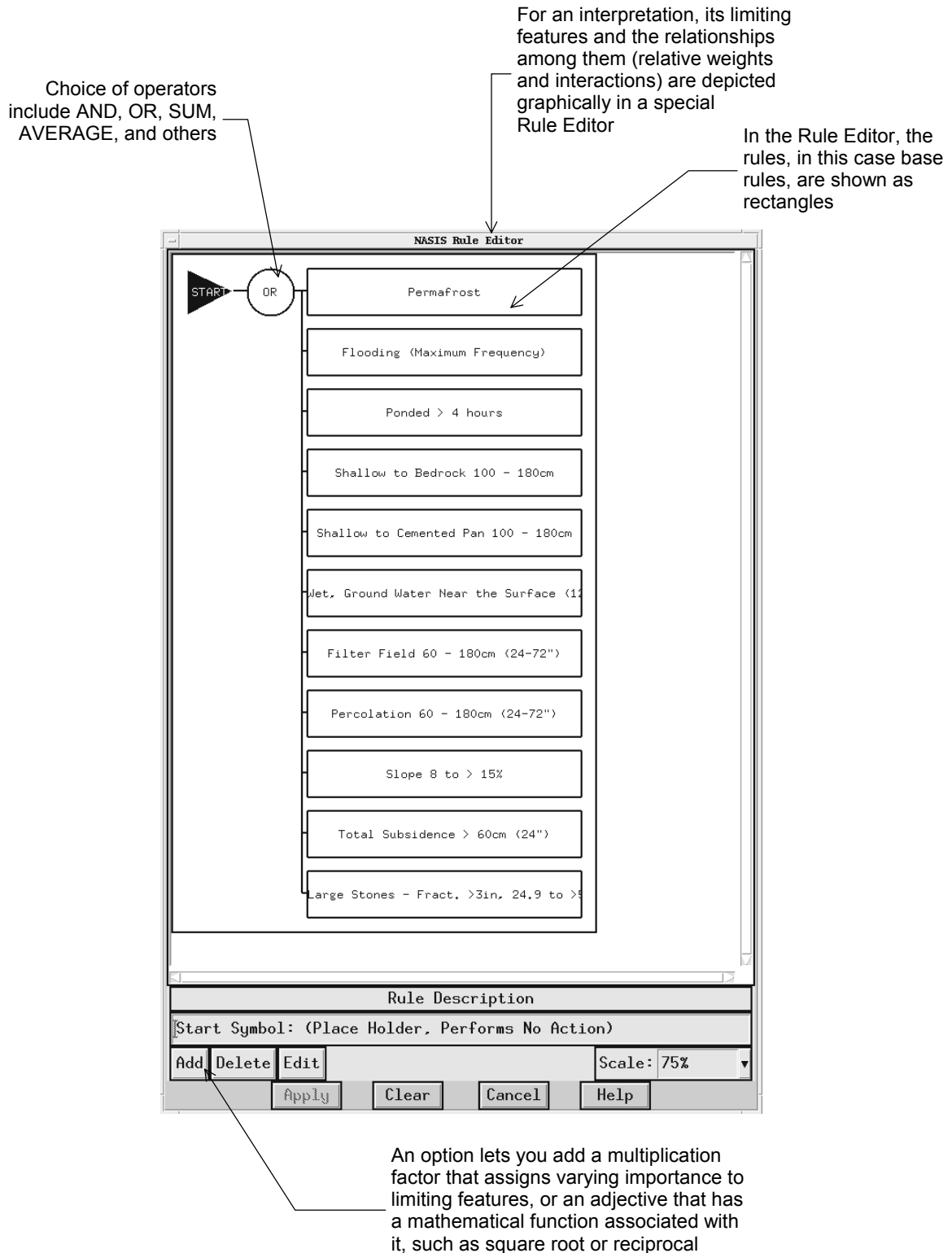
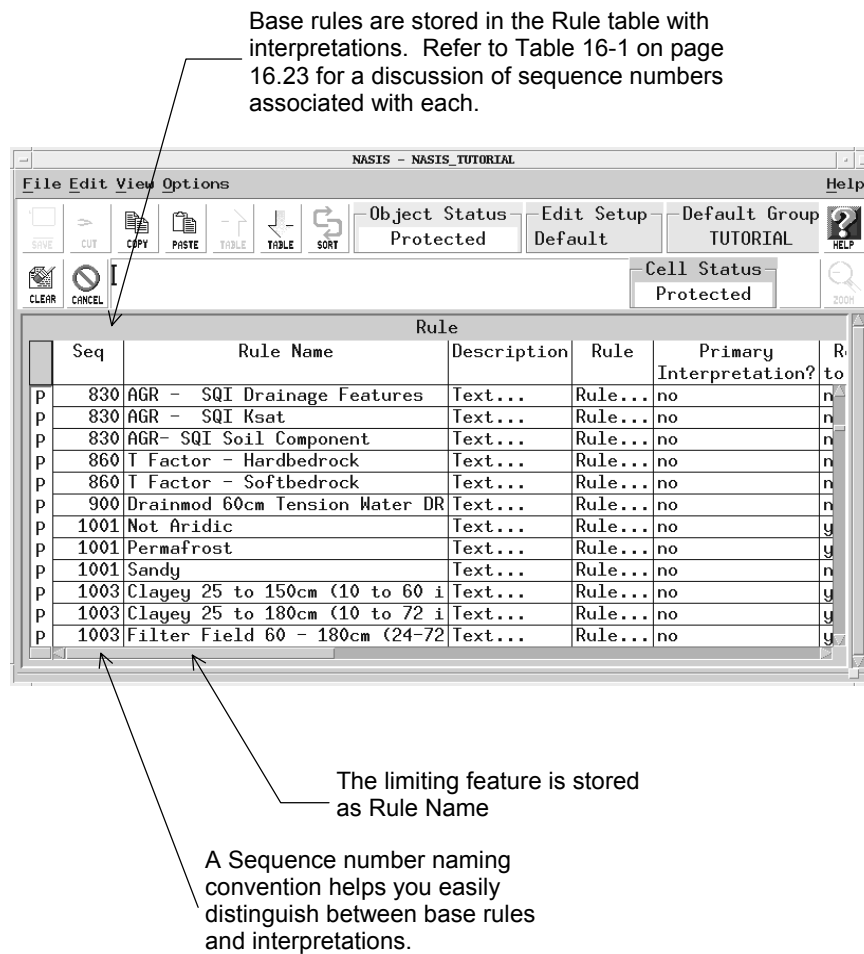


Figure 16-2. Rule Editor Depicting Base Rules

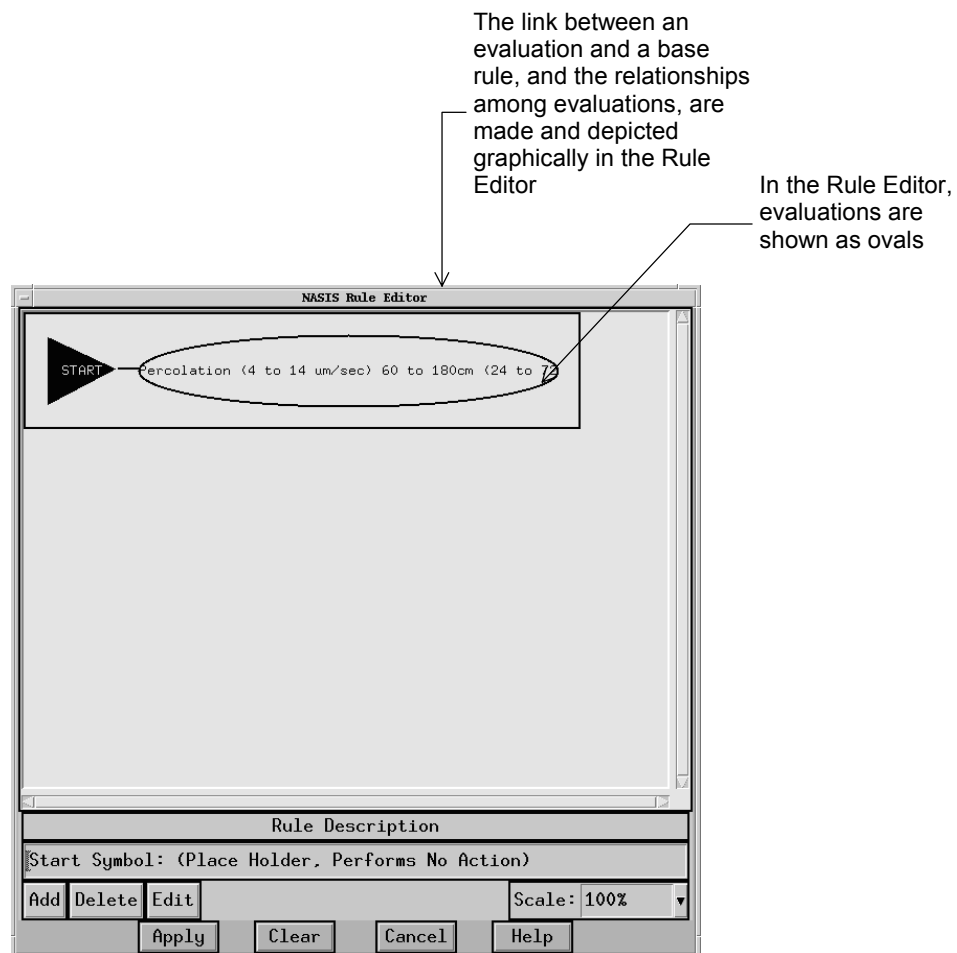
## Base rules

A *base rule* is a logical statement about one limiting feature. A base rule says nothing about the land use; therefore, the same base rule can be used in building different interpretations. Base rules are aggregated into an interpretation and are considered the basis, or building blocks, of an interpretation. Like interpretations, base rules are stored in the Rule table, as shown in Figure 16-3 below. The limiting feature is stored as the Rule Name. A naming guideline helps you distinguish base rules from interpretations.

Base rules have at least one evaluation linked to them. The linked evaluation(s) are depicted graphically in the Rule Editor shown in Figure 16-4 on the next page.



**Figure 16-3. Rule Table Displaying Base Rules**



**Figure 16-4. Rule Editor Showing Link to Evaluation**

In order to report out interpretive results, an evaluation must be linked to a base rule. The base rule gives you the flexibility of reusing evaluations for different interpretations.

## Evaluations

An *evaluation* is an assessment of a particular soil property for its relative impact as a limiting feature. Evaluations are stored in the Evaluation table as shown in Figure 16-5 below.

Using the principles of fuzzy logic (fully explained in Chapter 14), you can graph the impact in a special Evaluation Editor, as shown in Figure 16-6 on the next page. The graph helps you evaluate the soil property and its relative truthfulness of being a limiting feature. For example, if a soil percs absolutely too slowly, the fuzzy value would be 1. If it percs absolutely not too slowly, the fuzzy value would be 0.

Fuzzy logic allows you to evaluate the property when it falls in the range between absolutely too slowly (1) and absolutely not too slowly (0). For example, if the soil percs moderately slowly, you might plot it as 0.5, meaning that the soil has a 0.5 truthfulness of percolating absolutely too slowly.

An evaluation is the relationship between the property and its impact on the interpretive application.

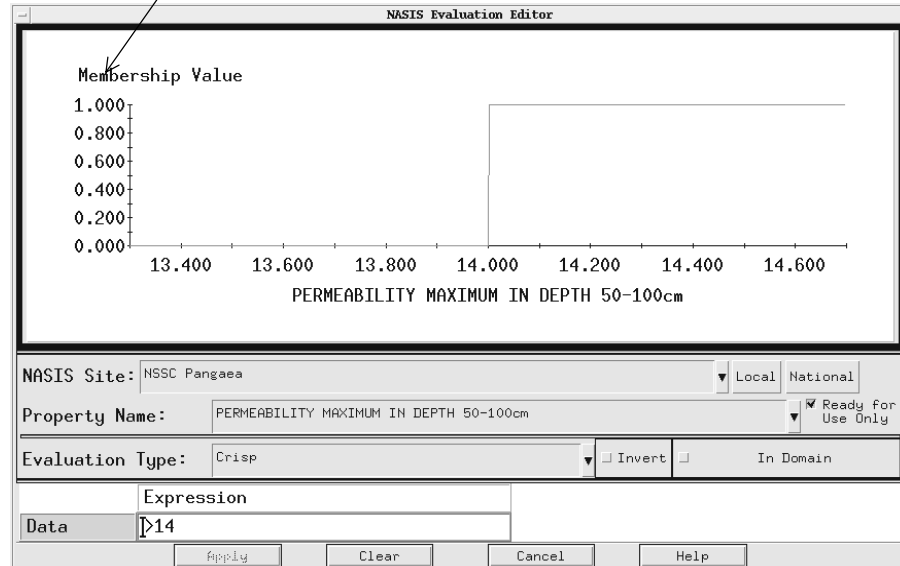
Evaluations are stored in the Evaluation table

A special Evaluation Editor (shown on the next page) allows you to graph the relationship between a property's value and its relative truthfulness of being a limiting feature

|   | Seq | Evaluation Name                | Description | Evaluation    | Ready to use? | NSS |
|---|-----|--------------------------------|-------------|---------------|---------------|-----|
| p | 100 | Total Subsidence > 30cm (12")  | Text...     | Evaluation... | yes           | NSS |
| p | 100 | Total Subsidence > 60cm (24")  | Text...     | Evaluation... | yes           | NSS |
| p | 101 | Permafrost (Consolidated) InLi | Text...     | Evaluation... | yes           | NSS |
| p | 101 | Permafrost (Permanently Frozen | Text...     | Evaluation... | yes           | NSS |
| p | 101 | Shallow to Permafrost (50 to 1 | Text...     | Evaluation... | yes           | NSS |
| p | 102 | Filter Field 0 to 150cm (0 to  | Text...     | Evaluation... | yes           | NSS |
| p | 102 | Filter Field 60 to 150cm (24 t | Text...     | Evaluation... | yes           | NSS |
| p | 102 | Permeability (50-100cm) >14    | Text...     | Evaluation... | yes           | NSS |
| p | 102 | Seepage 50 to 180cm (20 to 72" | Text...     | Evaluation... | yes           | NSS |
| p | 103 | Percolation (1 - 4 um/sec) 0 t | Text...     | Evaluation... | yes           | NSS |
| p | 103 | Percolation < 2 um/sec to 150c | Text...     | Evaluation... | yes           | NSS |
| p | 103 | Percolation (4 to 14 um/sec) 6 | Text...     | Evaluation... | yes           | NSS |

Figure 16-5. Evaluation Table

The Evaluation Editor lets you translate the ranges of properties into a uniform basis, which in fuzzy logic is a value between 0 and 1 where 1 means a statement is absolutely true and 0 means a statement is absolutely not true



**Figure 16-6. Evaluation Editor**

Evaluations specify the ranges used to assess the relative truthfulness of a statement about a soil property. For example, the evaluation criteria set the limits for determining whether the statements “soil percs too slowly” and “soil filters too poorly” are absolutely not true, absolutely true, or somewhere in between.

Fuzzy logic allows us to deal with relative statements about soil properties. For example, in our traditional view, the logical statement A AND B means that both A and B must be absolutely true for the statement to be true. But with fuzzy logic, each of A and B represent some degree of truthfulness (membership in a class), from absolutely *not* true to absolutely true. The statement A AND B evaluates the minimum truthfulness for either of A and B. Thus, if a soil must be deep and dry in March to be suitable for early tillage, and the soil is deep but moist, the statement that the soil is deep is true but the statement that the soil is dry is only partly true. Therefore, the soil is partly suited to early tillage.

This statement about soil behavior can be understood in terms of relative truthfulness. If the soil is very nearly dry, then its degree of truthfulness is very nearly 1 (perhaps 0.9), and it is very nearly suited (0.9) to early tillage. The degree of truthfulness is numerical and can be used in mathematical operations or converted into classes such as slight, moderate, and severe. Regardless of how you use it, fuzzy logic allows you to make more intuitive, more precise, and more useful interpretations. This concept helps you deal with relative statements about soil properties. If you have not already done so, refer to Chapter 14 for a full discussion of fuzzy logic.

## Properties

A *property* is the specified soil data retrieved from the soil database. The term *property* can also refer to the SQL-like statement that retrieves the soil data. Properties are stored in the Property table, as shown in Figures 16-7 and written in the text editor as shown in Figure 16-8.

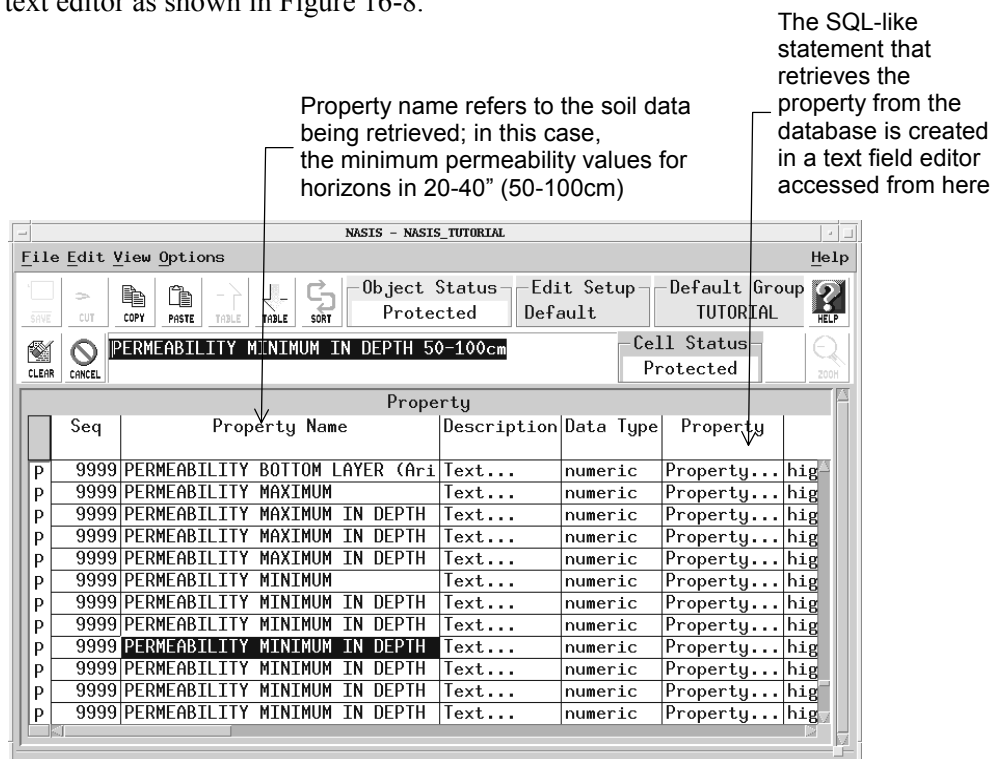


Figure 16-7. Property Table

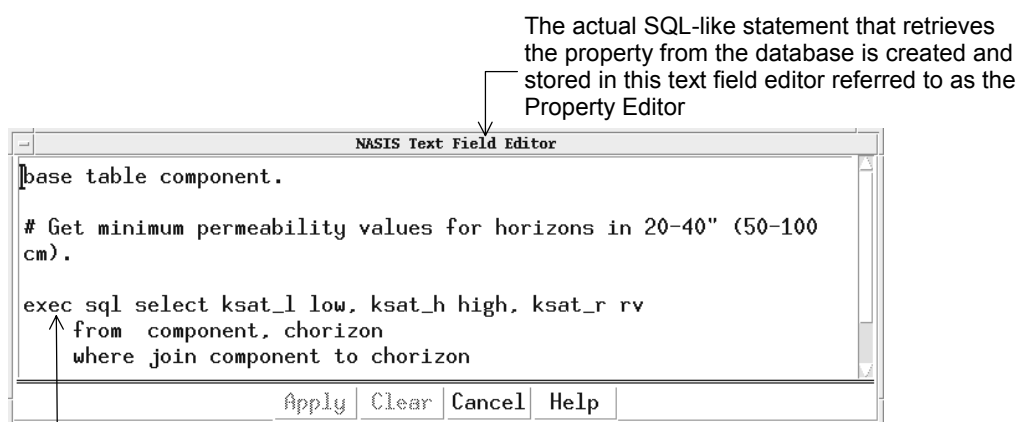


Figure 16-8. Property Editor



## Summary

Figure 16-9 below illustrates that base rules focus on one limiting feature and must link to at least one evaluation. Base rules say nothing about the land use. Therefore, you can use them in different interpretations. Base rules are aggregated into an interpretation and are considered the basis, or building blocks, of an interpretation.

An evaluation is the relationship between a property's value and its relative truthfulness of being a limiting feature.

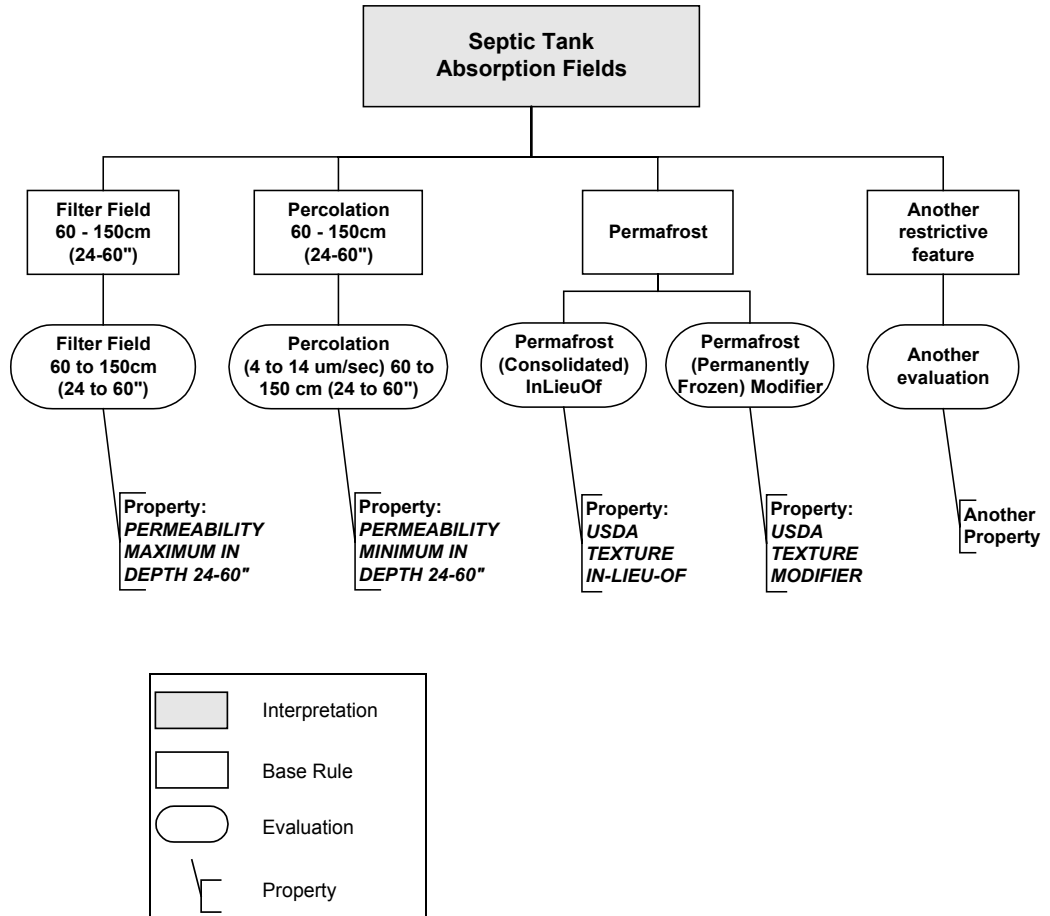


Figure 16-9. Relationships Among Interpretive Criteria

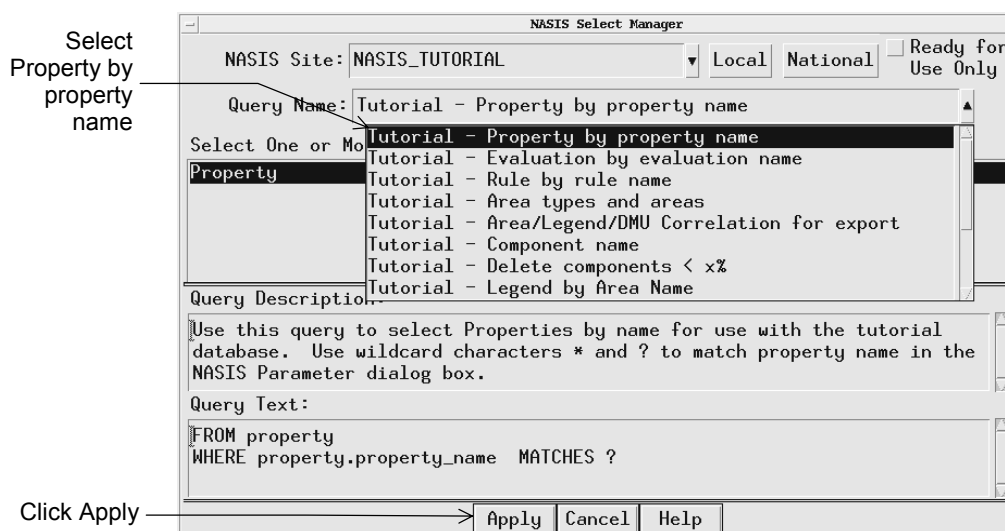
## Loading and Viewing Existing Criteria

Before you develop some sample interpretive criteria, take some time to view existing criteria and become familiar with the editors.

### Loading existing criteria into the selected set

In this section, you will use the Select Manager to load all of the national properties, evaluations, base rules, and interpretations into your selected set.

1. On the NASIS **File** menu, choose **Select**.
2. In the Select Manager, open the choice list for the Query Name field.
3. Select **Tutorial - Property by property name** and click **Apply**.



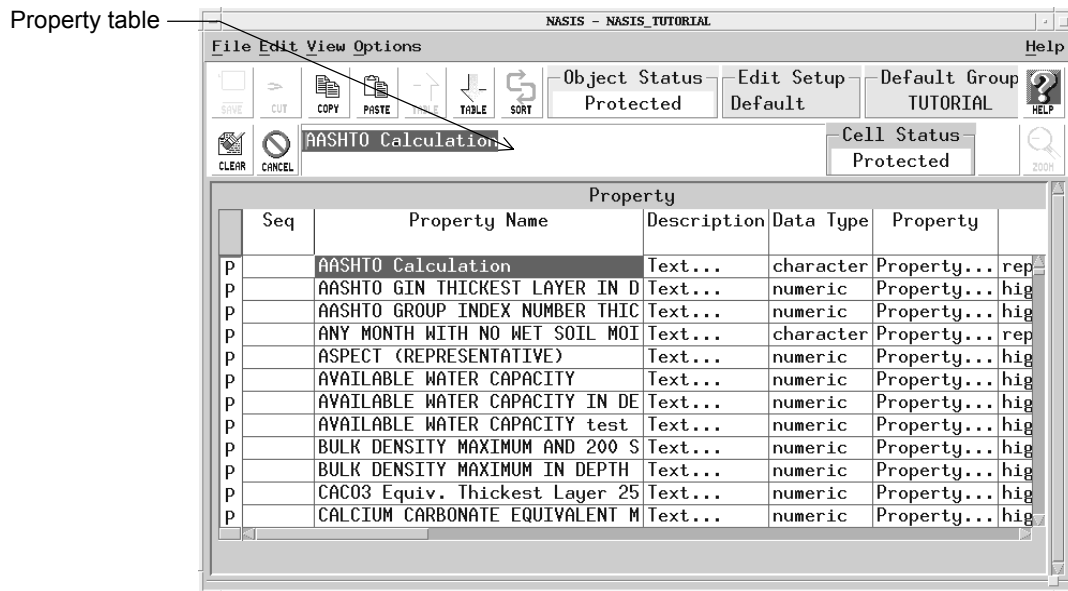
4. In the Query Parameters dialog, type \* to return all properties owned by the NSSC Pangaea, then click **Apply**.
5. A message reports 657 rows added to the selected set. Click **OK**.  
**Note:** If the number returned differs somewhat, it is probably because more properties, evaluations and rules are continually being added by NSSC Pangaea.
6. In the Select Manager, choose the query **Tutorial - Evaluation by evaluation name**, and click **Apply**.
7. Type \* then click **Apply**.
8. A message reports 1161 rows added. Click **OK**.
9. In the Select Manager, choose the query **Tutorial - Rule by rule name**, and click **Apply**.
10. Type \* then click **Apply**.
11. A message reports 1495 rows added. Click **OK**.
12. On the Select Manager, click the **Cancel** button.

## Viewing existing properties

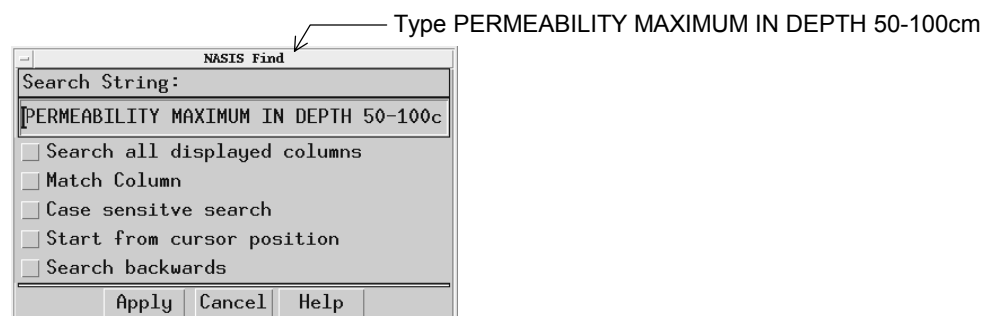
You can retrieve properties from the NSSC Pangaea site using complex SQL-like statements. Because of their complexity, it is unlikely that you will edit or create properties. Instead, you will likely choose existing ones from a choice list.

When developing criteria, however, you may need to open the Property table and make sure the property you want to retrieve has an SQL-like statement written for it.

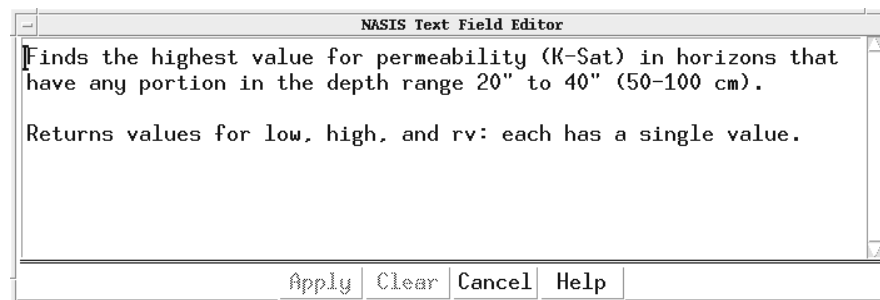
1. Open the Property table by selecting the **View, Properties**, then click **Property**.



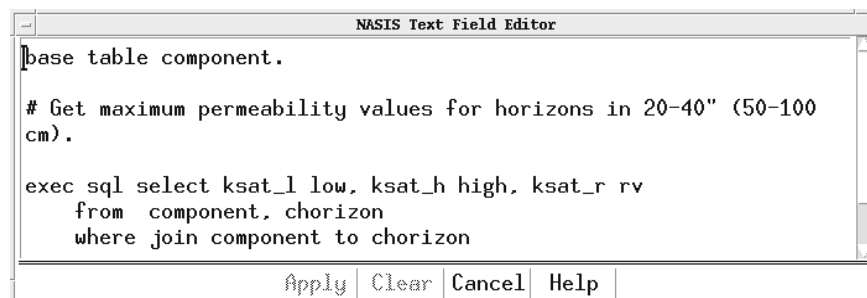
2. You will use the Find function to locate a particular property and examine it. To begin, click the **Property Name** column.
3. On the **View** menu, select **Find** (near the bottom of the menu).
4. In the Search String field, type **PERMEABILITY MAXIMUM IN DEPTH 50-100 cm** and click **Apply** (as shown below).



5. With the selected property displayed, click in the **Text...** column, click the **Zoom** button.
6. In the Text Field Editor, read the description of this property, shown below.



7. When finished reading the text, click **Cancel**.
8. In the Property table, click the **Property** column for the selected property, then click the **Zoom** button. A text field editor, referred to as the Property editor, displays the SQL-like statement that retrieves the property PERMEABILITY MAXIMUM IN DEPTH 50 - 100 cm.

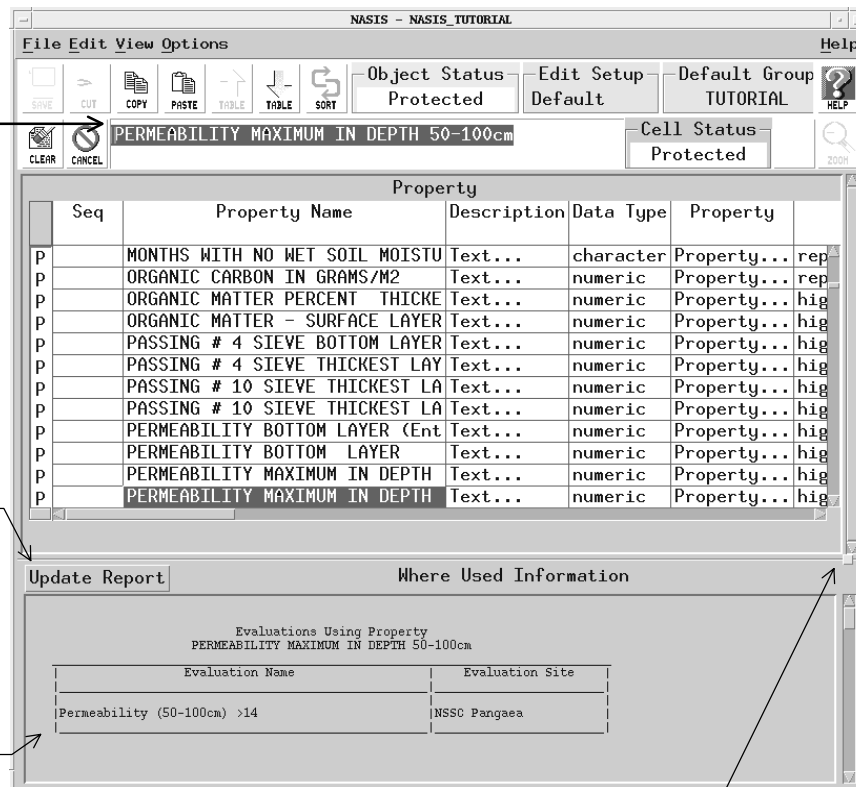


9. When finished viewing this text, click the **Cancel** button.
10. You can easily see which evaluations use this property by raising the **Sash** and clicking the **Update Report** button (as shown on the next page).

When several properties contain similar names, view the full name in the edit window.

Click Update Report

Where Used report shows evaluation(s) that use the selected property



Move the cursor over the sash box and when the pointer converts to cross-hairs, click your mouse button, hold it down, and move the Sash box upward. Release the mouse button when you can see the Where Used report below

**Note:** The Where Used report lists the evaluations that use the selected property.

- When finished looking at the Where Used report, browse through the Property table to examine other properties; or proceed to the next section.

## Viewing existing evaluations

Next you will look at the evaluation that uses PERMEABILITY MINIMUM IN DEPTH 60 - 150 cm.

- Open the Evaluation table by selecting the **View** menu, **Evaluations**, then click **Evaluation**.

**Note:** You may need to scroll to view the evaluation that uses the permeability property. (A sample screen appears on the next page.)

The evaluation that uses the permeability property, as detailed in the Where Used report

NASIS - NASIS\_TUTORIAL

File Edit View Options Help

SAVE CUT COPY PASTE TABLE TABLE SORT Object Status Protected Edit Setup Default Default Group TUTORIAL HELP

CLEAR CANCEL Permeability (50-100cm) >14 Cell Status Protected ZOOM

| Seq | Evaluation Name                    | Description | Evaluation    | Ready to use? |     |
|-----|------------------------------------|-------------|---------------|---------------|-----|
| p   | Drainage Class                     | Text...     | Evaluation... | no            | NSS |
| p   | Free Water 1/3 bar                 | Text...     | Evaluation... | no            | NSS |
| p   | Free Water 1/10 bar                | Text...     | Evaluation... | no            | NSS |
| p   | Slope                              | Text...     | Evaluation... | no            | NSS |
| p   | 100 Total Subsidence > 30cm (12")  | Text...     | Evaluation... | yes           | NSS |
| p   | 100 Total Subsidence > 60cm (24")  | Text...     | Evaluation... | yes           | NSS |
| p   | 101 Permafrost (Consolidated) InLi | Text...     | Evaluation... | yes           | NSS |
| p   | 101 Permafrost (Permanently Frozen | Text...     | Evaluation... | yes           | NSS |
| p   | 101 Shallow to Permafrost (50 to 1 | Text...     | Evaluation... | yes           | NSS |
| p   | 102 Filter Field 0 to 150cm (0 to  | Text...     | Evaluation... | yes           | NSS |
| p   | 102 Filter Field 60 to 150cm (24 t | Text...     | Evaluation... | yes           | NSS |
| p   | 102 Permeability (50-100cm) >14    | Text...     | Evaluation... | yes           | NSS |

Update Report Where Used Information

Evaluations Using Property  
PERMEABILITY MAXIMUM IN DEPTH 50-100cm

| Evaluation Name             | Evaluation Site |
|-----------------------------|-----------------|
| Permeability (50-100cm) >14 | NSSC Pangaea    |

**Note:** Sequence numbers in the Evaluation table can be used to group, maintain, and develop evaluations. Unless sequence numbers are used, a *save* or *sort* command will arrange the records in this table in alphabetical order.

- For the percolation record, highlight the **Text...** column and click the **Zoom** button. The Text Field Editor displays a description of the evaluation (shown on the next page).

Indicates the property checked by this evaluation →

Defines the fuzzy space →

Includes the Ames description of the property →

Describes the calculation used →

NASIS Text Field Editor

This evaluation checks the filtering capacity of the soil. The high, low, and representative values for sat\_hydraulic\_conductivity are selected for each horizon between depths of 50 to 100 cm.

The fuzzy space is defined as the condition:  
Where the soil horizon property sat\_hydraulic\_conductivity >= 14 micrometers/second (2.0 inches/hr), the evaluation is absolutely true and the restrictive feature is seepage.

If no data is entered, then an artificial default value(s) is used.

Ames Description Prior to 1996

| LIMITS            | IRESTRICTIVE                 |
|-------------------|------------------------------|
| PROPERTY          | I SLIGHT I MODERATE I SEVERE |
| 1 FEATURE         |                              |
| 5. 4/PERMEABILITY | ---                          |
| >2.0 SEEPAGE      | ---                          |
| (IN/HR) (20-40")  |                              |

4/Disregard (1) in all Aridisols except Salorthids and Aquic subgroups, (2) all Aridic subgroups, and (3) all Torri great groups of Entisols except Aquic subgroups.

Description of Calculation:  
+ \_\_\_\_\_

If not disregarded, the values given on the Soils-5 for permeability are examined and a high value for each layer is determined. The high value used for comparison depends on which of the following conditions is met first.

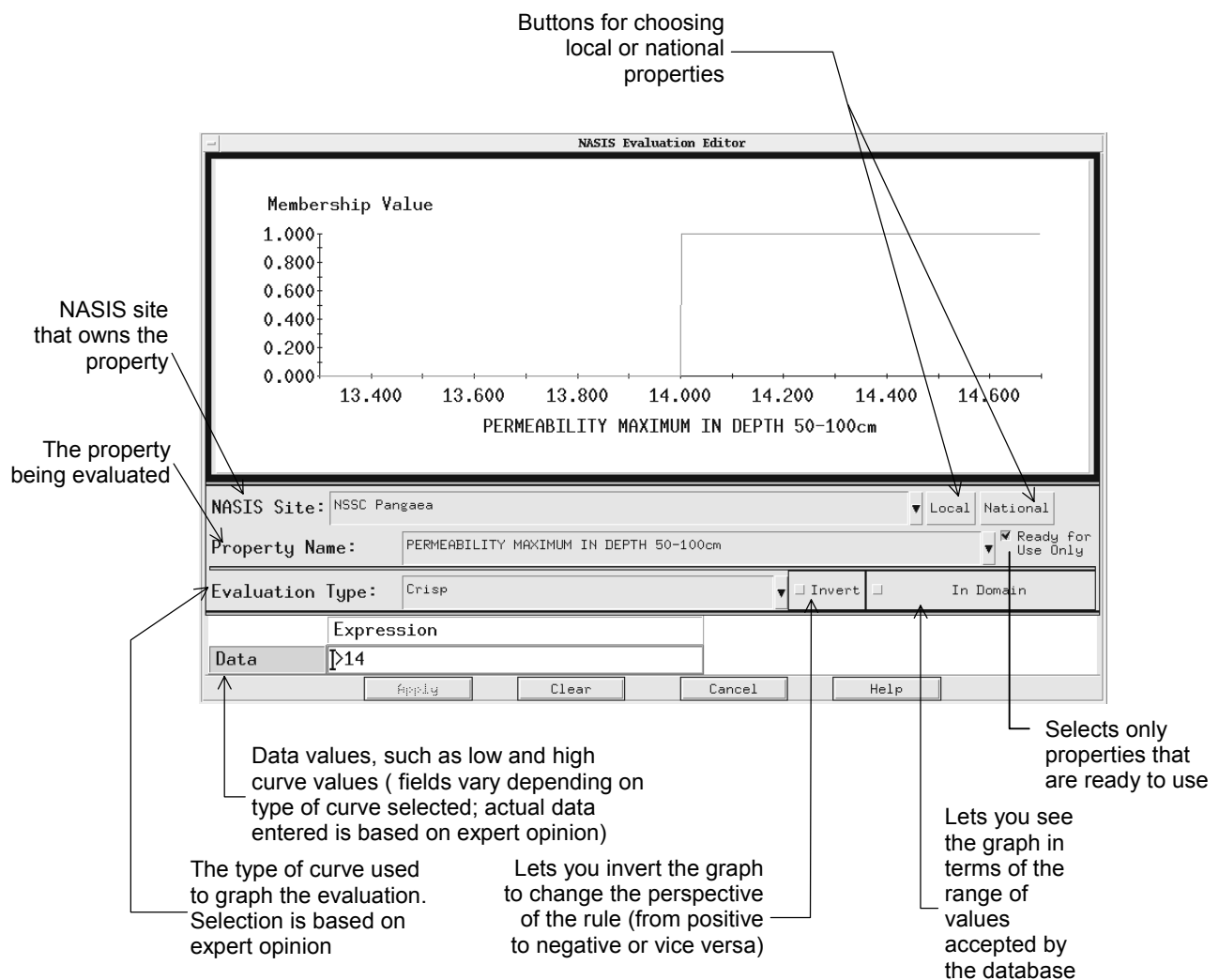
If no data is entered, then an artificial value of 0 is used.  
If the entry is a single number or is of the form '<xx', then the single value entered is used.

If the entry is of the form '>xx', then an artificial value of 100 is used.

Otherwise the high value is used.

Apply Clear Cancel Help

3. After reading the description, click **Cancel** to return to the Evaluation table.
4. Open the Evaluation Editor by clicking the **Evaluation** column, then clicking the **Zoom** button. The Evaluation Editor appears, as shown in the sample screen on the next page.



5. After viewing the Evaluation editor, click **Cancel** to close it.
6. To determine what base rules use this evaluation, in the Evaluation table click the **Update Report** button.



The screenshot shows the NASIS - NASIS\_TUTORIAL application window. The main window has a menu bar (File, Edit, View, Options) and a toolbar with icons for Save, Cut, Copy, Paste, Table, Sort, Object Status (Protected), Edit Setup (Default), Default Group (TUTORIAL), Cell Status (Protected), and a Help icon. Below the toolbar is a table titled "Evaluation".

| Seq   | Evaluation Name                | Description | Evaluation    | Ready to use? |     |
|-------|--------------------------------|-------------|---------------|---------------|-----|
| P     | Drainage Class                 | Text...     | Evaluation... | no            | NSS |
| P     | Free Water 1/3 bar             | Text...     | Evaluation... | no            | NSS |
| P     | Free Water 1/10 bar            | Text...     | Evaluation... | no            | NSS |
| P     | Slope                          | Text...     | Evaluation... | no            | NSS |
| P 100 | Total Subsidence > 30cm (12")  | Text...     | Evaluation... | yes           | NSS |
| P 100 | Total Subsidence > 60cm (24")  | Text...     | Evaluation... | yes           | NSS |
| P 101 | Permafrost (Consolidated) InLi | Text...     | Evaluation... | yes           | NSS |
| P 101 | Permafrost (Permanently Frozen | Text...     | Evaluation... | yes           | NSS |
| P 101 | Shallow to Permafrost (50 to 1 | Text...     | Evaluation... | yes           | NSS |
| P 102 | Filter Field 0 to 150cm (0 to  | Text...     | Evaluation... | yes           | NSS |
| P 102 | Filter Field 60 to 150cm (24 t | Text...     | Evaluation... | yes           | NSS |
| P 102 | Permeability (50-100cm) >14    | Text...     | Evaluation... | yes           | NSS |

An arrow points from the text "Click Update Report to see which base rules link to the selected evaluation" to the "Update Report" button at the bottom of the window.

The "Update Report" dialog is open, showing the "Where Used Information" section. It displays the status of the selected evaluation: "Permeability (50-100cm) >14". It lists the property used in this evaluation and the rules using this evaluation.

| Property Name                          | Property Site |
|----------------------------------------|---------------|
| PERMEABILITY MAXIMUM IN DEPTH 50-100cm | NSSC Pangaea  |

| Rule Name                   | Rule Site    |
|-----------------------------|--------------|
| Seepage 50 - 100cm (20-40") | NSSC Pangaea |

An arrow points from the text "One rule is linked to the highlighted evaluation" to the rule "Seepage 50 - 100cm (20-40") in the table.

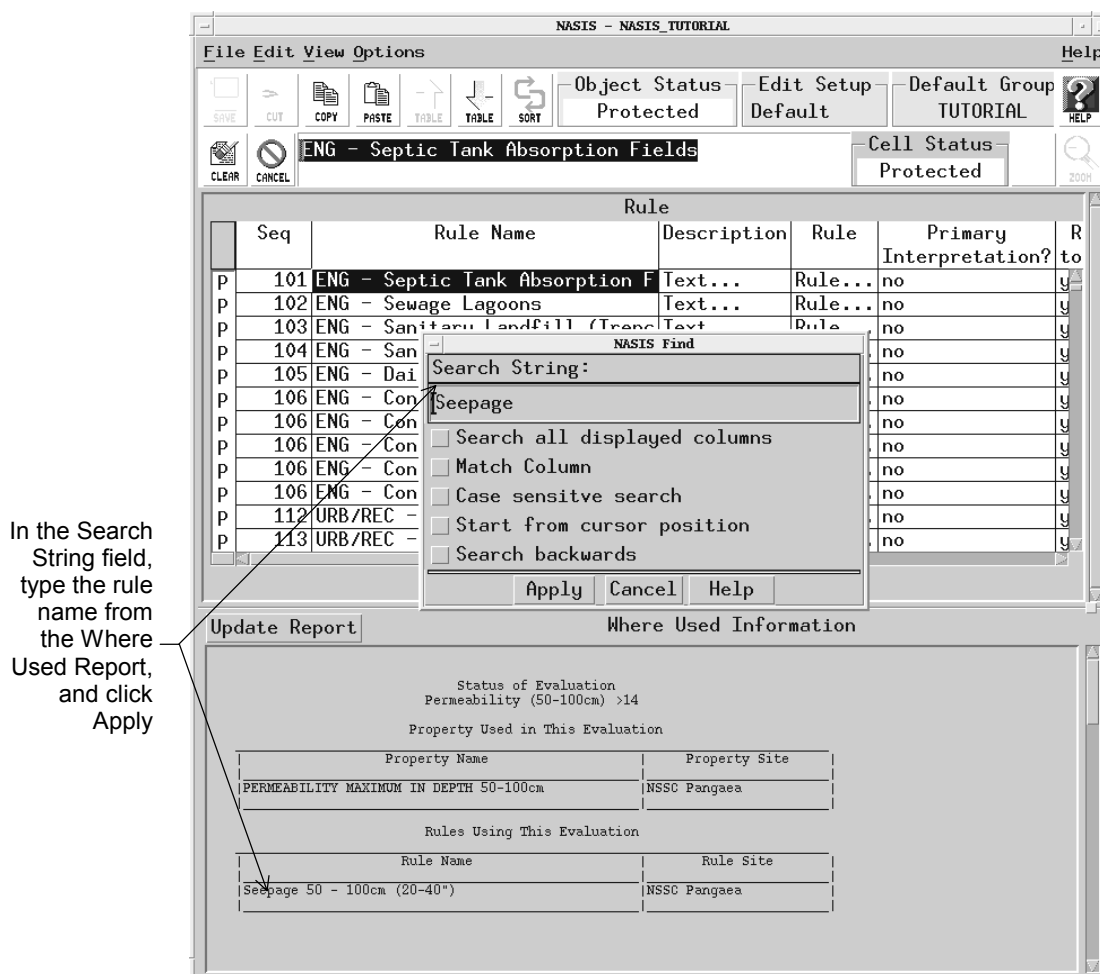
**Note:** As shown above, the evaluation is linked to one base rule: Seepage 50 - 100cm (20-40").

### Viewing existing base rules

Before writing rules, look at the base rule named Seepage 50 - 100cm (20-40"). In doing so, you can acquaint yourself with the Rule table and Rule Editor. Recall that you loaded into the selected set all rules from the national database.

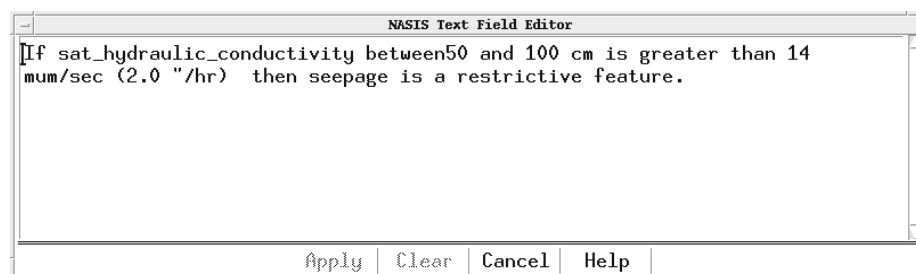
1. Open the Rule table by selecting the **View** menu, **Rules**, then clicking **Rule**.
2. With the cursor in the **Rule Name** column, select the **View** menu, then click **Find**.
3. Type the name of the base rule and click **Apply**. Refer to the sample screen.

## NASIS Getting Started

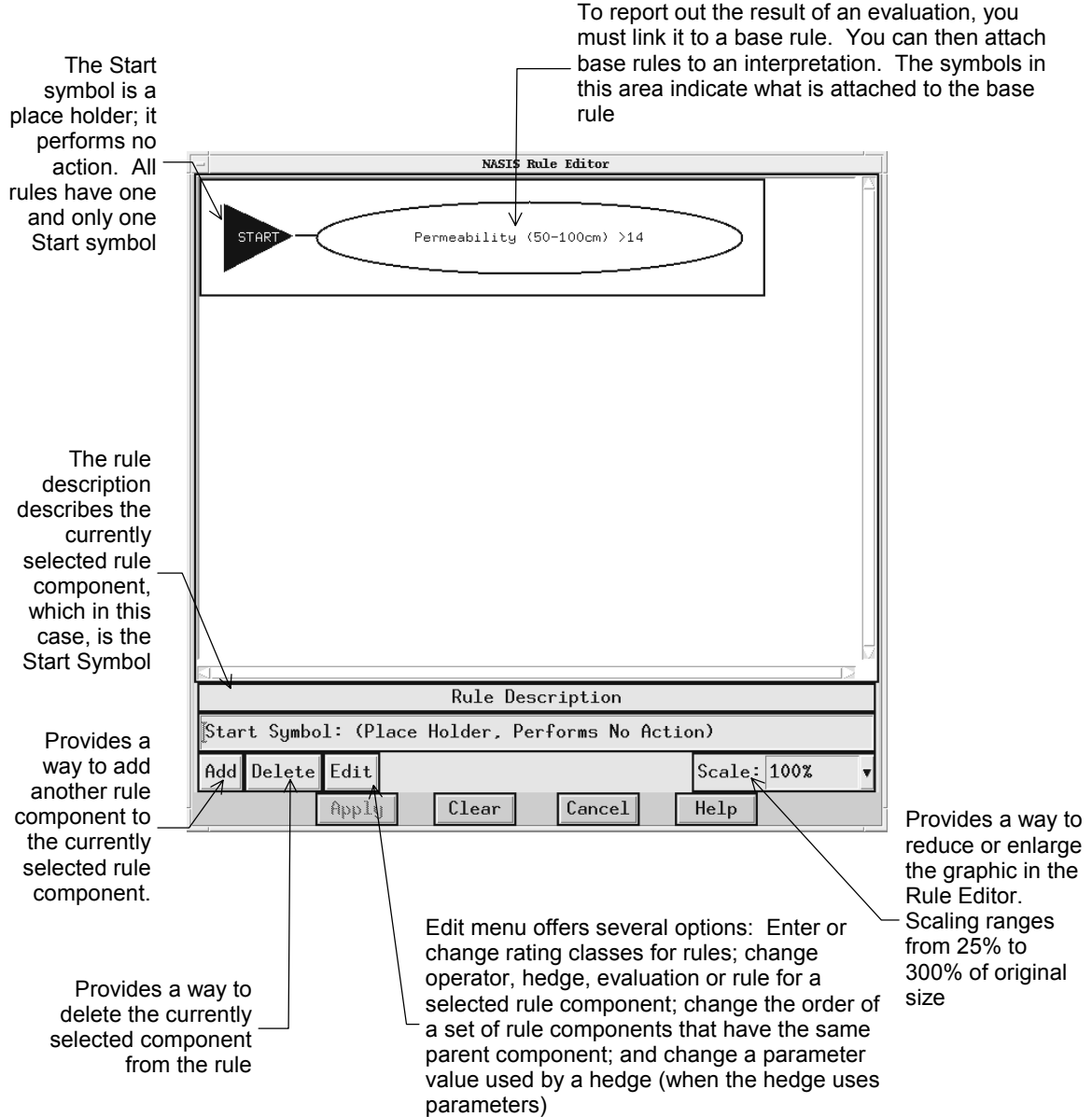


**Note:** The search string (or partial string) can be alpha-numeric characters. Wildcards are not accepted, but partial words are, such as Perc for Percolation.






- Highlight the **Text...** column and click the **Zoom** button. Read the rule description.



- When finished looking at the text, click **Cancel**.
- In the Rule table, open the Rule Editor by clicking the **Rule** column then clicking the **Zoom** button.

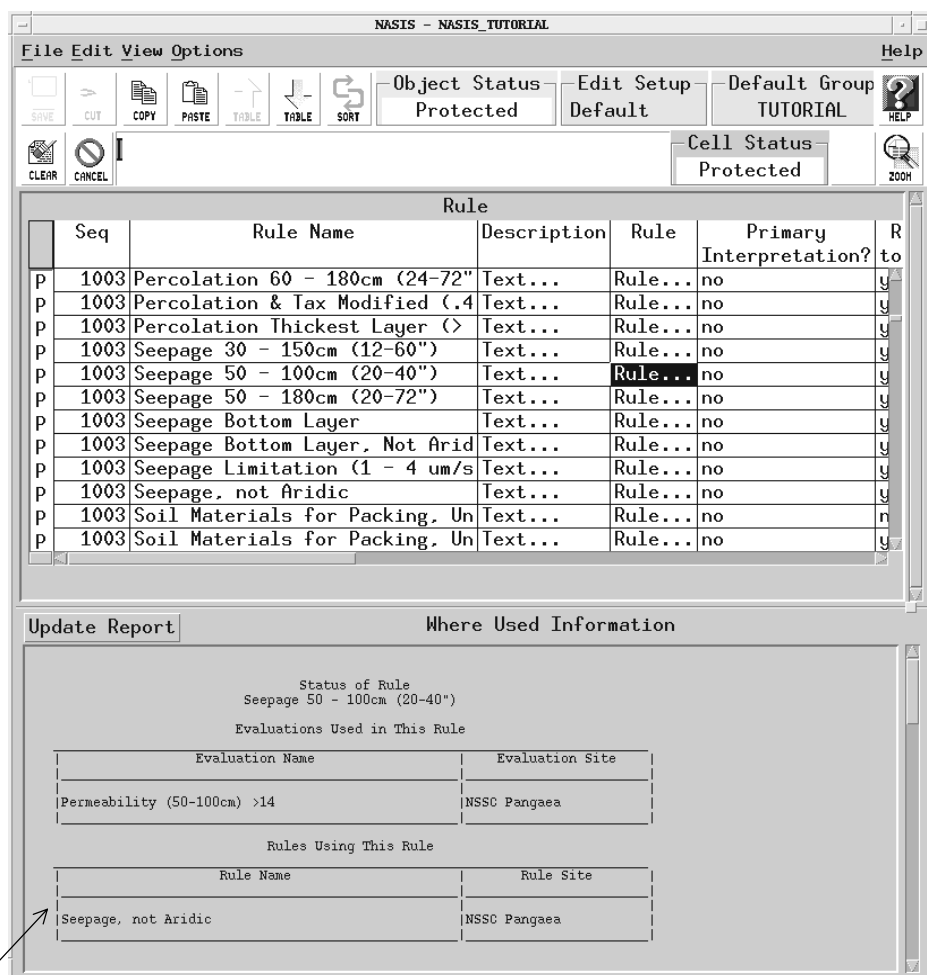


**Note:** The Rule Editor lets you illustrate the interpretation or base rule graphically with symbols called rule components. Refer to Figure 16-10 on the next page for a description of each rule component.

- Rectangle  - Rule
- Oval  - Evaluation
- Circle  - Operator
- Square  - Hedge
- Triangle  - Start Symbol

**Figure 16-10. Rule Components and Symbols**

7. When finished looking at the Rule Editor, click **Cancel**.
8. To find out which other rules or interpretations use this base rule, raise the **Sash** and click the **Update Report** button.



Another rule—Seepage, not Aridic uses the Permeability base rule

9. Click **Rule** in the **Seepage, not Aridic** row.
10. Click **Update Report**.

The screenshot shows the NASIS - NASIS\_TUTORIAL application window. The main window has a menu bar (File, Edit, View, Options, Help) and a toolbar with icons for Save, Cut, Copy, Paste, Table, Sort, Object Status, Edit Setup, Default Group, Cell Status, and Zoom. Below the toolbar is a table titled "Rule" with columns: Seq, Rule Name, Description, Rule, Primary Interpretation?, and R. The table contains 13 rows of rules. The row with Seq 1003 and Rule Name "Seepage, not Aridic" is highlighted. Below the table is a section titled "Update Report" with a sub-section "Where Used Information". This section contains two tables: "Rules Used in This Rule" and "Rules Using This Rule". The "Rules Used in This Rule" table has columns "Rule Name" and "Rule Site" and contains two rows: "Not Aridic" and "Seepage 50 - 100cm (20-40\*)". The "Rules Using This Rule" table also has columns "Rule Name" and "Rule Site" and contains one row: "ENG - Sanitary Landfill (Area)". An arrow points from the text "The ENG prefix identifies this rule as an interpretation" to the "ENG - Sanitary Landfill (Area)" row in the "Rules Using This Rule" table.

The ENG prefix identifies this rule as an interpretation

| Seq    | Rule Name                      | Description | Rule    | Primary Interpretation? | R |
|--------|--------------------------------|-------------|---------|-------------------------|---|
| P 1003 | Percolation 60 - 180cm (24-72" | Text...     | Rule... | no                      |   |
| P 1003 | Percolation & Tax Modified (.4 | Text...     | Rule... | no                      |   |
| P 1003 | Percolation Thickest Layer (>  | Text...     | Rule... | no                      |   |
| P 1003 | Seepage 30 - 150cm (12-60")    | Text...     | Rule... | no                      |   |
| P 1003 | Seepage 50 - 100cm (20-40")    | Text...     | Rule... | no                      |   |
| P 1003 | Seepage 50 - 180cm (20-72")    | Text...     | Rule... | no                      |   |
| P 1003 | Seepage Bottom Layer           | Text...     | Rule... | no                      |   |
| P 1003 | Seepage Bottom Layer, Not Arid | Text...     | Rule... | no                      |   |
| P 1003 | Seepage Limitation (1 - 4 um/s | Text...     | Rule... | no                      |   |
| P 1003 | Seepage, not Aridic            | Text...     | Rule... | no                      |   |
| P 1003 | Soil Materials for Packing, Un | Text...     | Rule... | no                      |   |
| P 1003 | Soil Materials for Packing, Un | Text...     | Rule... | no                      |   |

| Rule Name                   | Rule Site    |
|-----------------------------|--------------|
| Not Aridic                  | NSSC Pangaea |
| Seepage 50 - 100cm (20-40*) | NSSC Pangaea |

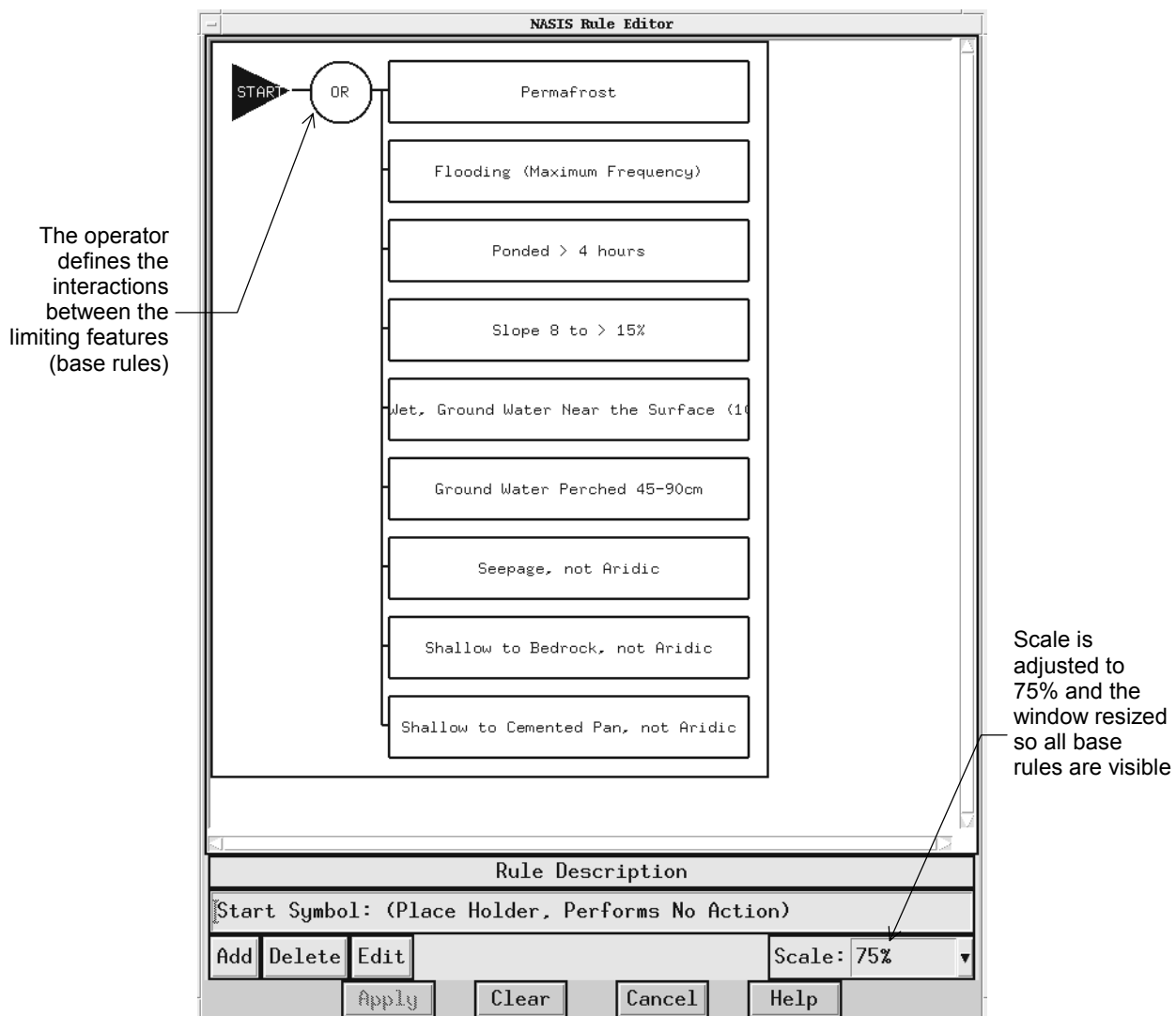
| Rule Name                      | Rule Site    |
|--------------------------------|--------------|
| ENG - Sanitary Landfill (Area) | NSSC Pangaea |

## Viewing existing interpretations

Because interpretations are stored in the Rule table along with base rules, you can stay in the Rule table to view them. In this section, you will learn a guideline for naming interpretations so you can easily distinguish them from base rules.

1. Move the cursor to the top of the Rule table. The *ENG - Sanitary Landfill (Area)* interpretation is Sequence number 104.
2. In that row, select the **Text...** column and click the **Zoom** button.  
**Note:** The description is from the National Soil Survey Handbook.
3. After reading the description, click **Cancel** to close the text editor.
4. Open the Rule Editor by highlighting the **Rule** column and clicking **Zoom**. (See the sample screen on the next page.)

**Note:** You may need to adjust both your window size and display scale (refer to graphic below) to view the rule editor. The full rule is not visible on some screens. Scroll, if necessary, to view base rules.



5. When finished looking at the interpretation, click the **Cancel** button.
6. In the Rule Table, scroll down and look at the various records. Notice that a naming convention for interpretations includes a 3-letter prefix such as ENG, AWM, FOR, etc.

**Note:** You can also use sequence numbers to differentiate between interpretations and base rules, as shown on the next page in Table 16-1. Notice that sequence numbers reflect the disciplines that interpretations and base rules fall under.

| Discipline                     | Interpretation Sequence Numbers | Base Rule Sequence Numbers |
|--------------------------------|---------------------------------|----------------------------|
| Standard Engineering (ENG)     | 100-199                         | 1000-1999                  |
| Waste Management Systems (WMS) | 200-299                         | 2000-2999                  |
| Ag Waste Management (AWM)      | 300-399                         | 3000-3999                  |
| Water Quality (WAQ)            | 400-499                         | 4000-4999                  |
| Forestry (FOR)                 | 500-599                         | 5000-5999                  |
| Grazing Land (GRL)             | 600-699                         | 6000-6999                  |
| Wildlife (WLF)                 | 700-799                         | 7000-7999                  |
| Agronomy (AGR)                 | 800-899                         | 8000-8999                  |
| Urban (URB)                    | 900-999                         | 9000-9999                  |
| Recreation (REC)               |                                 |                            |

Table 16-1. Sequence Numbers for Interpretations and Base Rules

**Note:** National interpretations included with NASIS 4.0 and shown here are not yet official interpretations but provided now for the purposes of testing and review.

- When finished browsing through the interpretations in the Rule table, go on to the next section where you can construct some sample criteria.

## Constructing Interpretive Criteria

In the following exercise you will use the interpretive statement discussed in Chapter 14: *A site has limitations for picnic areas if it is too steep or too wet.* Properties (such as slope and minimum depth to water table) are (1) retrieved from the database, (2) evaluated according to the criteria's truth or membership function (0.6 and 0.4), and (3) used in interpretations to make statements about the property's effect on the specific interpretive application.

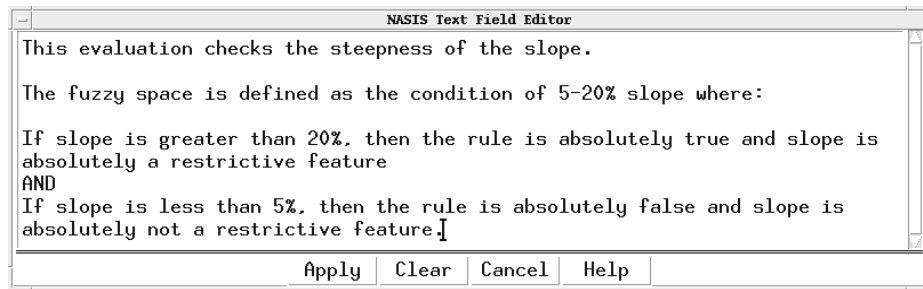
As previously mentioned, three of the four parts of the NASIS interpretive criteria are interpretations, base rules and evaluations. You will construct these using the two graphical editors: Rule editor and Evaluation editor. Recall that the fourth aspect of interpretive criteria is the *property*. Before you can evaluate an interpretive statement you must define the relevant property.

We know that a property is the specified soil data (for example, the *slope* data element) or soil characteristic (for example, depth to water table, which is not a data element) retrieved from the soil database. In the example of picnic areas, the properties are slope and minimum depth to water table. In this exercise, you will use existing properties but create new evaluations, base rules, and an interpretation.

### Creating new evaluations

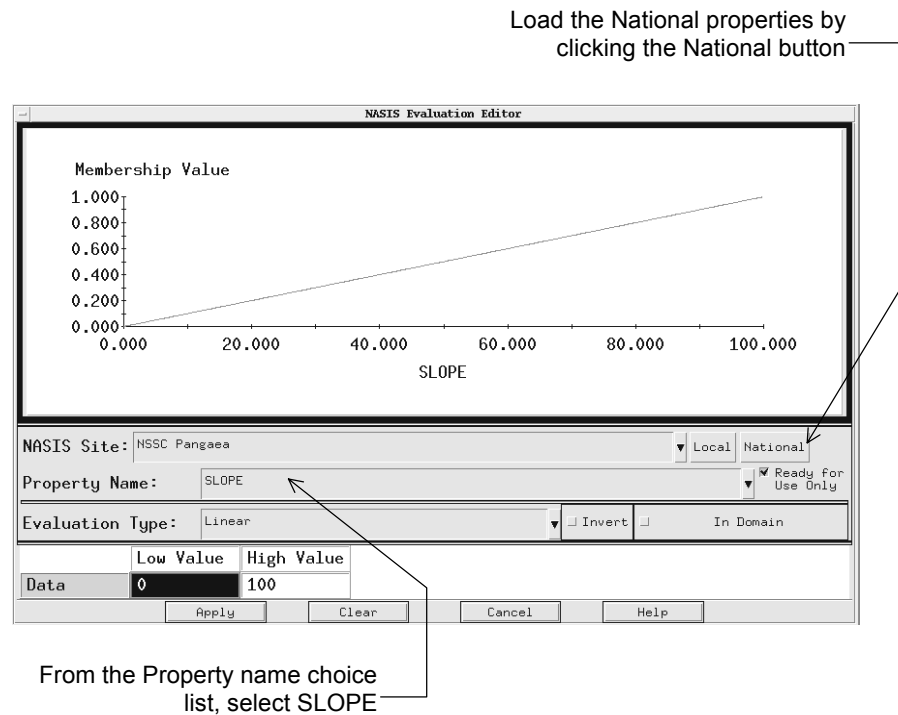
For the picnic area scenario, you will create one evaluation from scratch and copy and modify one existing evaluation. For tutorial purposes, you can safely assume that the two properties you want to evaluate—SLOPE and DEPTH TO HIGH WATER TABLE MINIMUM—exist as already-written properties.

1. Clear the selected set by selecting the **File** menu, then clicking **New**. This helps improve performance, if you and others are working through the lesson simultaneously.
2. Click **View, Evaluations, Evaluation** to open the Evaluation table, which is presently empty.
3. To create a new evaluation for the picnic area scenario, first insert a new row into the Evaluation table by clicking **F8**.
4. For sequence number (Seq), type **5004**, then press **ENTER**.  
**Note:** Sequence numbers in the Evaluation table can be used to group, maintain, and develop evaluations. Recall that sequence numbers reflect the disciplines that interpretations and base rules fall under. The same can be true for evaluations. See Table 16-1 on the previous page.
5. For Evaluation Name, type **Slope evaluation for tutorial**.
6. Highlight the **Description** field and click **Zoom**.
7. Type a description something like the one in the sample screen below.



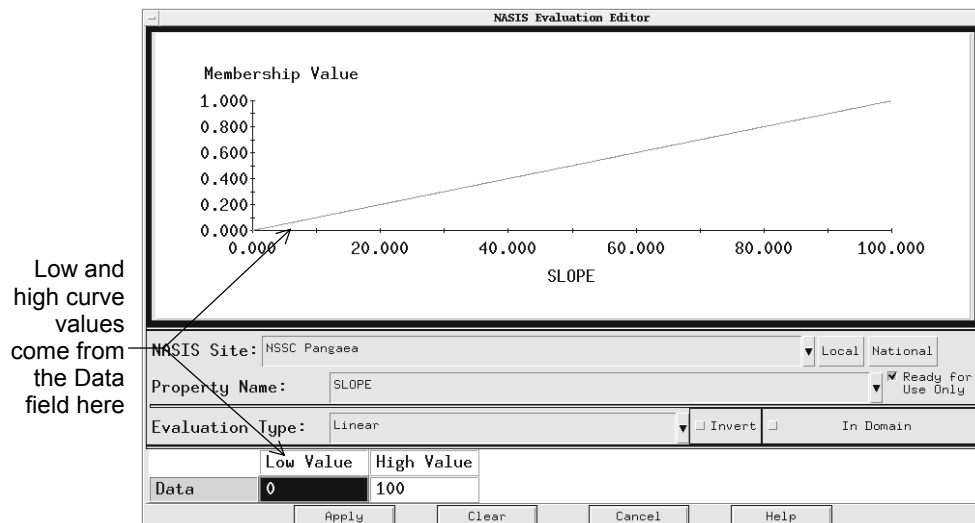
8. After typing the description, click **Apply**.
9. Open the Evaluation Editor by highlighting **Evaluation...** and clicking **Zoom**.
10. To create the evaluation, first load the national properties by clicking the **National** button.
11. In the **Property Name** choice list, scroll down and select **SLOPE**.





**Note:** By default, the evaluation type for slope is *linear*. As an expert, you have the option of selecting the most relevant curve. For this example, however, use linear curve.

12. In the Data field, type a Low Value of **5** and a High Value of **20**, then press ENTER. The graph now reflects these values (resized and shown below).



13. If you think you want to write the interpretation as “If the soil is not too steep then it does not have limitations for picnic areas,” you can use the Invert option to change it. Click the **Invert** button now. It changes the perspective.

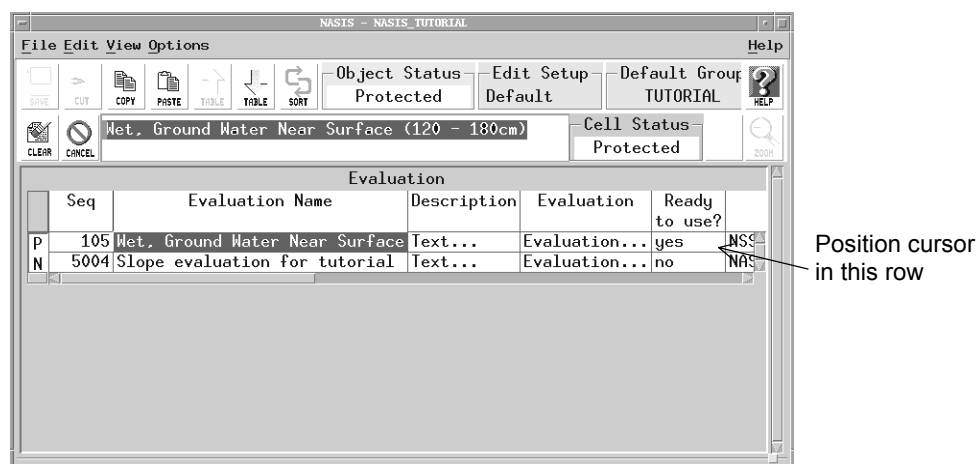
**Note:** If you change the perspective of an evaluation already linked to a base rule and an interpretation, you will likely need to change the wording of those as well.

14. For the purposes of the picnic area example, undo the **Invert** by clicking it again, then close the Editor by clicking **Apply**.

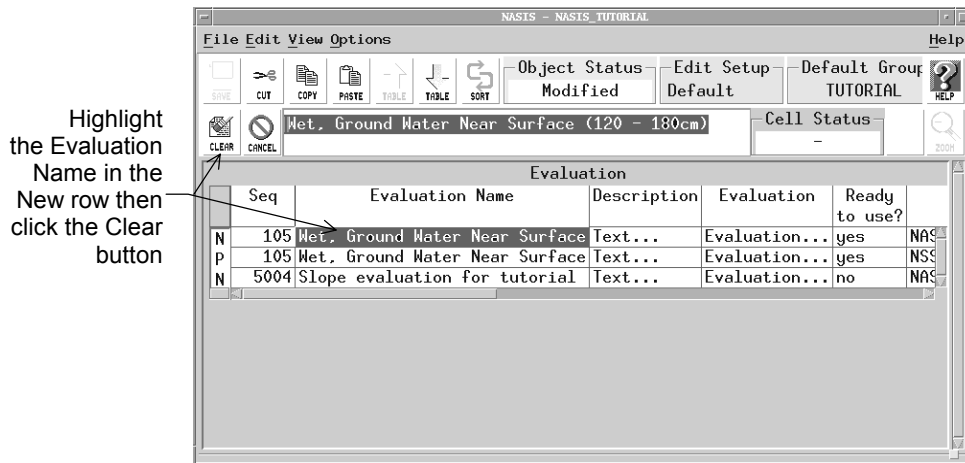
**Note:** Normally, you would save the evaluation to the database, but the save function is disabled in the tutorial database.

**Note:** In the Evaluation table, next you will create a new evaluation for wetness, but instead of building a new one, you will load an existing one, then copy and modify it.

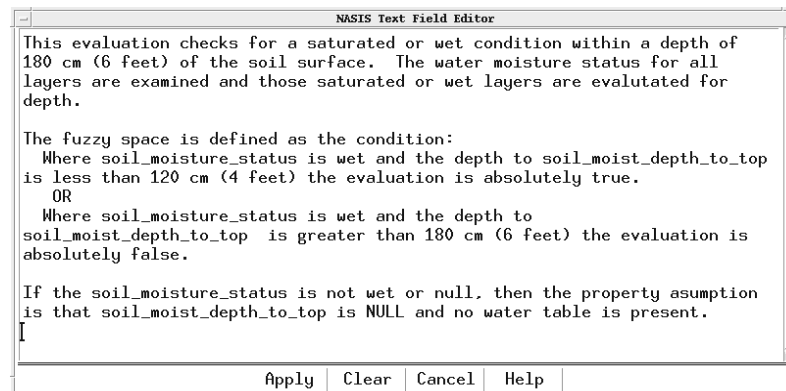
15. On the **File** menu, choose **Select**.
16. Select the query **Tutorial - Evaluation by evaluation name** and click **Apply**.
17. In the Query Parameters dialog, type **Wet, Ground Water Near Surface (120\***, then click **Apply**.
18. A message informs you of one row added. Click **OK**, then cancel the Select Manager. The Evaluation table now has another row.



19. With the cursor on the evaluation, click the **Copy** button.
20. When the cursor is active again, click the **Paste** button.
21. Highlight the **Evaluation Name** of the new record (row status N for new) and click the **Clear** button on the NASIS toolbar.



22. Type **Wetness evaluation for tutorial** and press ENTER.
23. To type a description, first highlight **Text...**, then click the **Zoom** button.
24. Resize the Text Field Editor to see more of the description.
25. Read the description of the evaluation you copied to determine what applies to the new evaluation.
26. Delete the Ames description by highlighting it and clicking **BACKSPACE** (or **DELETE**).
27. When finished editing the description (sample content below), click **Apply**.



Click Apply

28. Open the Evaluation Editor by highlighting **Evaluation** and clicking the **Zoom** button.
29. In the Editor, change Evaluation Type to a **Linear** curve (the data values—119.9 and 180.1—are automatically deleted).
30. Enter the data values: low value is **0** and high value is **120**, then press ENTER.
31. Looking at the curve, notice that the 0.000 minimum depth to high water table means false or absolutely not true, but our interpretive statement states that 0.000 is true. For this situation, **invert** the curve.

32. You have finished creating the wetness evaluation, so click **Apply** to close the Evaluation Editor.

**Note:** You now have created two new evaluations, one for slope and one for wetness. However, evaluations can not be reported out unless they are linked to a base rule.

## Creating new base rules

Next, you will create two base rules to attach the evaluations to. To report out the result of an evaluation, you must create a rule and attach the evaluation to it.

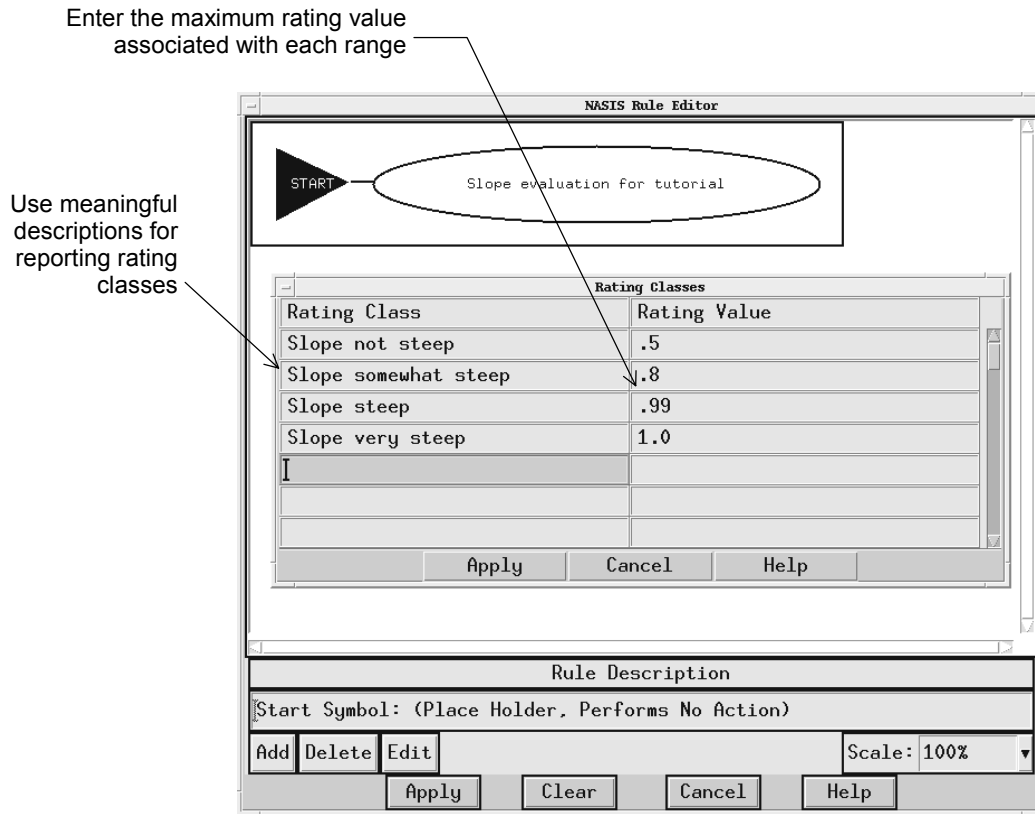
1. Open the Rule table by selecting the **View** menu, **Rules**, then clicking **Rule**.
2. In the Rule table, insert a new row by pressing **F8**.
3. For sequence number, type **5998**.
4. For Rule Name, type **Slope base rule for tutorial**.
5. Highlight the **Text** field and click **Zoom**.
6. Type the text in the sample screen below, then click **Apply**.

7. Highlight the **Rule** field and click **Zoom**. The Rule Editor appears with one rule component—Start Symbol.
8. Click the **Add** button and select **Evaluation**.
9. The Select Evaluation dialog appears. Use the arrow to the right of the Evaluation field to locate the **Slope evaluation for tutorial**. Highlight it, then click the **Apply** button.

**Note:** In the Rule Editor, an oval represents an evaluation.

10. Click the **Edit** button and select **Rating Class**.
11. Fill in the rating classes and values as shown in the following diagram.

**Note:** The **TAB** key moves between fields.



**Note:** You may enter a maximum of fifty rating classes per rule.

12. Click **Apply** to close the Rating Classes dialog.
13. In the Rule Editor, click **Apply** to accept the rule and close the editor.
14. In the Rule table, insert another row by clicking **F8**.
15. For sequence number, type **5999**.
16. Name this rule **Wetness base rule for tutorial**.
17. Highlight the **Text** field and click **Zoom**.
18. Type the following: **If soil is wet then wetness is a restrictive feature. This rule is a base rule of FOR - Picnic areas for tutorial**; then click **Apply**.
19. Highlight the **Rule** field and click **Zoom**.
20. Click the **Add** button and select **Evaluation**.
21. From the Evaluation choice list, select **Wetness evaluation for tutorial**, then click **Apply**.
22. Click the **Edit** button and select **Rating Class**.
23. Fill in the rating classes and values as shown here.

**Rating Classes**

| Rating Class      | Rating Value |
|-------------------|--------------|
| Soil not wet      | 0.5          |
| Soil somewhat wet | 0.8          |
| Soil wet          | .99          |
| Soil very wet     | 1.0          |
|                   |              |
|                   |              |
|                   |              |

Buttons: Apply, Cancel, Help

**Rule Description**

Start Symbol: (Place Holder, Performs No Action)

Buttons: Add, Delete, Edit, Scale: 100% (dropdown), Apply, Clear, Cancel, Help

24. Close the Rating Classes dialog by clicking **Apply**.
25. Accept the rule as written and close the Rule Editor by clicking **Apply**.

**Note:** You have written two new base rules each with an evaluation linked to it. Now you can create an interpretation and link the two base rules to it.

### Creating a new interpretation with two base rules

In this portion of the lesson, you will create an interpretation, attach two base rules to it, and then generate and preview the interpretation using the Interpretation Manager.

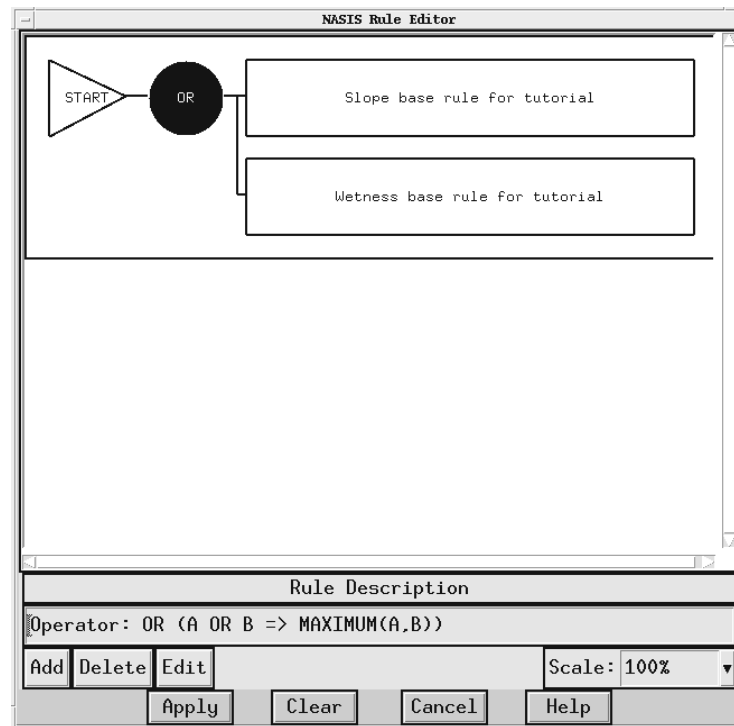
1. Because interpretations are stored in the Rule table, press **F8** to insert a new row.
2. For sequence number, type **599**.
3. For the Rule Name, enter **FOR - Picnic areas for tutorial**.
4. Highlight the **Text** field and click **Zoom**.
5. In the Text Field Editor, type a statement such as that shown in the following example, then click **Apply**.

NASIS Text Field Editor

If soil is too steep or too wet, the there are limitations for picnic areas.  
This is an interpretation with two base rules linked to it.]

Buttons: Apply, Clear, Cancel, Help

6. Open the Rule Editor by highlighting the **Rule** field and clicking **Zoom**.  
**Note:** The Rule Editor opens with the Start Symbol displayed. The Start Symbol is a place holder; it performs no action. The Rule Editor is where you attach base rules to an interpretation.
7. The interpretive statement states that the interaction between steepness and wetness is based on the OR condition. Add the OR operator by clicking the **Add** button and selecting **Operator**, the **OR**.
8. To add the first of the two evaluations, click the OR operator attached to the Start Symbol, then click the **Add** button and select **Rule**.
9. In the Select Rule dialog, click the arrow to display the choices for rules found in the tutorial database. You see the two base rules you created. Select **Slope base rule for tutorial**, then click **Apply**.  
**Note:** Slope evaluation for tutorial is linked to the interpretation as shown by the rectangle symbol.
10. With the **OR** Symbol selected, click the **Add** button and select **Rule**.
11. This time, select the **Wetness base rule for tutorial**, then click **Apply**. The Rule Editor appears like the sample screen on the top of the next page.



- Note:** You have linked two base rules to an interpretation. This action will take the fuzzy analysis of wetness and of slope and return the most restrictive result as the fuzzy logic rating for the overall interpretation.
12. To create rating classes for the interpretation, click the **Edit** button then select **Rating Class**.

**Note:** Again, the Rating Classes dialog is where you, as the expert, define the rating classes associated with a range of values for a particular rule. These adjective descriptions are used to defuzzify rating values.

13. In the Rating Classes dialog, define four classes for this interpretation: **Not limiting**, **Limiting**, **Very limiting**, and **Extremely limiting**.
14. For each class, enter the maximum value of the range associated with the rating class, as in the following sample screen.

The screenshot shows the NASIS Rule Editor interface. At the top, a rule diagram shows a 'START' node connected to an 'OR' node, which then branches into two boxes: 'Slope base rule for tutorial' and 'Wetness base rule for tutorial'. Below this is the 'Rating Classes' dialog, which contains a table with the following data:

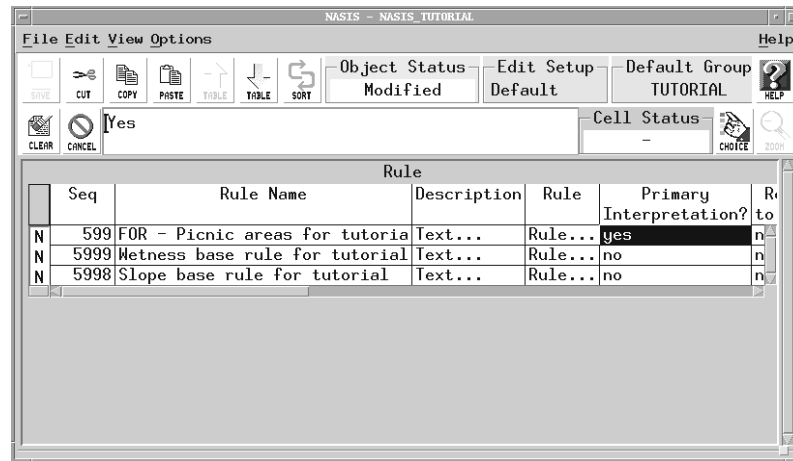
| Rating Class                     | Rating Value |
|----------------------------------|--------------|
| Slope/wetness not limiting       | 0.6          |
| Slope/wetness limiting           | 0.9          |
| Slope/wetness very limiting      | .99          |
| Slope/wetness extremely limiting | 1.0          |
|                                  |              |
|                                  |              |

Below the table are buttons for 'Apply', 'Cancel', and 'Help'. Underneath is the 'Rule Description' section, which shows the operator: 'OR (A OR B => MAXIMUM(A,B))'. At the bottom are buttons for 'Add', 'Delete', 'Edit', 'Apply', 'Clear', 'Cancel', 'Help', and a 'Scale' dropdown set to '100%'.

**Note:** In this example, a value greater than 0 and less than .6 is not limiting; greater than .6 and less than .9 is limiting, greater than .9 and less than 1 is very limiting; and a value equal to 1 is extremely limiting.

15. Close the Rating Classes dialog by clicking **Apply**.
16. Position the cursor in the Primary Interpretation column, then click the Choice button.
17. Highlight **Yes**, then close the Choice dialog by clicking **Apply**.





**Note:** Top level interpretations are designated as primary. In the tutorial, the FOR – Picnic areas for tutorial interpretation is not called by any other interpretation. Decisions about suitability of the location as a picnic area is based on the rating provide by this interpretation. Had this interpretation been a subitem to (called by) another interpretation, the Primary Interpretation filed would have kept the default setting of No.

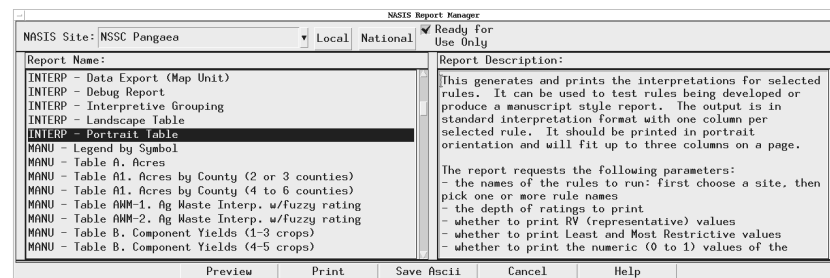
**Note:** You have finished creating the interpretation with two base rules. In the next section you will build a selected set, generate the interpretation, and then preview the report.

## Generating an Interpretation with Two Base Rules

In this lesson, you can use the same selected set you built for Chapters 13 and 14. Like all reports in NASIS, data in the selected set is the basis of this report.

In Chapter 13, you ran the *Tutorial - Soil survey area, all data* query to retrieve data for Canyon County, a published soil survey correlated in September 1985. Refer to pages 13.2-4 if you need more information about reloading the data, then proceed to step 1 below.

1. On the **Options** menu, select **Standard Reports**.
2. In the Report Manager, select the **National** site and choose **INTERP – Portrait Table** report.



3. The report parameters dialog is displayed.

## NASIS Getting Started

NASIS Report Parameters

Rule Name

NASIS Site: NASIS\_TUTORIAL Local National

FOR - Picnic areas for tutorial  
Slope base rule for tutorial  
Wetness base rule for tutorial

☐ Ready for Use Only  
☐ Primary Rules Only

Reporting Depth

Print RV (Low and High) ☐  
Print Least/Most Restrictive ☐  
Print Fuzzy Rating Values ☐

Maximum Non-Zero Reasons (0=All Reasons)

Name of Report

Apply Cancel Help

4. When you are ready to run the interpretation, click **FOR - Picnic areas for tutorial**.
5. In addition to the default selections, select the following: **Print RV, Reporting Depth of 2**, and **Maximum Non-Zero Reasons of 2**. The Report Name is optional. Type **FOR - Picnic areas for tutorial**. Click **Apply**, NASIS begins generating the interpretation.

NASIS Report Parameters

Rule Name

NASIS Site: NASIS\_TUTORIAL Local National

FOR - Picnic areas for tutorial  
Slope base rule for tutorial  
Wetness base rule for tutorial

☐ Ready for Use Only  
☒ Primary Rules Only

Reporting Depth 2

Print RV (Low and High) ☐  
Print Least/Most Restrictive ☐  
Print Fuzzy Rating Values ☐

Maximum Non-Zero Reasons (0=All Reasons) 2

Name of Report FOR - Picnic areas for tutorial

Apply Cancel Help

**Note:** If you did not load all the tables required to run this report, a message will indicate it.

6. When the Report Viewer appears, use the page down arrow or the scroll bars to look through the report (resized and shown below).

Report Viewer

Report Name:  Page  of

09/21/2000

FOR - Picnic areas for tutorial.  
CANYON COUNTY, TEST DATA: Detailed Soil I

| Map symbol and soil name | FOR - Picnic areas for tutorial                               |
|--------------------------|---------------------------------------------------------------|
| 12: Suncook-----         | Slope/wetness not limiting                                    |
| Occum-----               | Slope/wetness extremely limiting<br>**<br>Slope very steep ** |
| Not Named-----           | Slope/wetness extremely limiting<br>**<br>Slope very steep ** |
| Not Named Wet---         | Slope/wetness extremely limiting<br>**<br>Slope very steep ** |

\* INDICATES NULL DATA WAS USED.  
+ INDICATES DEFAULT VALUES WERE USED.

Print Save Cancel Help

7. After reviewing the interpretation result listing, click the **Cancel** button.
8. Click **Cancel** again to exit the Report Manager.

**Note:** You have finished Chapter 16. Go on to Chapter 17 for a lesson on writing custom queries.

